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ABSTRACT

This study concerns the goals of school mathematics in the curricula of African schools. Concerns about the state of mathematics education are noted: not only is achievement declining, but also there has been (1) a student population explosion, so that goals formulated two decades ago are no longer applicable, and (2) rapid growth of informatics (use of calculators and computers) and increased use of mathematics. Five questions were considered: (1) Who were the main agents of curriculum change? (2) What factors led to the changes? (3) What actual changes took place? (4) What were some of the major constraints? (5) What minimum competencies are expected? A questionnaire was mailed to 41 mathematicians or mathematics educators in 30 African countries, seeking information on educational structure and student population, major general goals of education, goals of mathematics at the primary and secondary levels, content of primary and secondary mathematics, curriculum changes of the 1960s and 1970s, the most important goals (minimum competencies), agents of curriculum change, time devoted to mathematics teaching, and language of instruction. Data from reporting countries are presented and discussed under these headings. (MNS)

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A STUDY OF GOALS OF MATHEMATICS EDUCATION IN AFRICA

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A STUDY OF THE GOALS OF MATHEMATICS EDUCATION IN AFRICA

BY

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A STUDY OF THE GOALS OF MATHEMATICS EDUCATION IN AFRICA

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G. S. ESHIWANI

INTRODUCTION:

It is slightly over three decades ago, at the dawn of political independence in most African countries, that the famous Addis Ababa Conference on the development of education was held. The Conference spelt out both quantitative goals as well as qualitative goals of education. While there has been some progress towards achieving the quantitative goals in most countries, there has been little improvement in the quality of education offered in many countries. The Addis Ababa conference observed that:-

> "The content of education in Africa is not in line with either existing African conditions, the postulates of political independence, the dominant features of an essentially technological age, or the imperatives of balanced economic development involving rapid industrialisation, but is based on non-African background allowing no room for the African child's intelligence, powers of observation and creative imagination to develop freely and help him find his bearing in the world".

This observation is still true for nearly all the educational systems in Africa today. Although attempts have been made from time to time to change the school curricula with a view to making it relevant, both in content and methods, the changes have tended to be more cosmetic and lacking in imagination.

The national goals of education in most countries have tended to deal with short-term solutions to social problems and have ignored the long-term needs. In many cases no new statements of the goals of education have been formulated. Instead such goals have been borrowed directly from either America or Europe. All this has led to gaps and weaknesses in the school curricula. Eshiwani, Omari and Yeloye (1983) have examined some of the weaknesses in their recent study: Localization of Curriculum in Africa. The study reported here was concerned with one aspect of curriculum - the goals of school mathematics.

Perhaps the most criticised subject in the school curriculum is mathematics. These criticisms have often been made by people who are ignorant of the content and methods of teaching and learning mathematics. However, there are genuine concerns that have been expressed by professionals concerning the state of mathematics education. Eshiwani (1979) claimed that mathematics standards have been falling over the last ten years; furthermore, pupils show less commitment to mathematics. These observations confirm previous conclusions by Kline (1973), Thom (1973), Preston (1973) and, Kempe and McGough (1977). There is a need to review not only what is taught in mathematics, but most urgently how it is taught. This inevitably calls for a review of the goals of mathematics education. In most African countries the urgency to review goals of mathematics education is greater for several reasons. Firstly, there has been a student population explosion at all levels, leading to limited classroom facilities, acute shortage of qualified mathematics teachers, and the educated unemployment problem. The goals that were formulated soon after independence (more than two decades ago) are no longer applicable today. Secondly, the rapid growth of informatics (the science of applying computers, mini-computers and calculators for treatment of data and information) and the increased usage of mathematics by Architects, Engineers, Scientists e.t.c. demand that there be a constant review of mathematics education in every country.

Purpose of the Study:

The main purpose of this study was to analyse statements of goals of mathematics teaching in Africa with a view to make recommendations on the guidelines for future formulations of new goals. In this regard, analysis of the changes that have taken place in school mathematics in the 1960s and 1970s was undertaken to answer the following questions among others:-

(a) Who were the main agents of curriculum change in school mathematics?

(b) What factors led to the changes in the school mathematics curriculum?

(c) What were the actual changes that took place in the mathematics curriculum?

(d) What were some of the major constraints experienced in achieving goals of mathematics education?

(e) In the light of the experiences of the 1970s, what is considered to be the minimum competency in mathematics expected of an average primary school leaver?

Method:

A questionnaire was mailed to 41 Mathematicians and/or Mathematics Educators known to the researcher in 30 African countries sampled from: Southern Africa, East and Central Africa, West Africa (Anglophone and Francophone) and North Africa.

The questionnaire sought information on the following aspects: educational structure, student population, major national goals of education (both at primary and secondary school levels), major goals of primary and secondary school mathematics, curriculum changes that took place in mathematics in the 1960s and 1970s, the time devoted to mathematics teaching, who makes curriculum decisions, and constraints in achieving goals of school mathematics. The questionnaire can be obtained from the Bureau of Educational Research, University of Nairobi.

In addition to the questionnaire, the researcher interviewed fifteen curriculum developers from various African countries who were on a special curriculum course at the Kenya Institute of Education in 1982 on issues related to mathematics education in their countries.

Results:

A word of caution to the reader is necessary at this point. Africa is a Continent. Countries within it vary historically and culturally. While there may be generalizations that could be made regarding education on the continent, many educational issues are unique to different regions or even countries. We will bear this in mind as we discuss our findings.

1. Context within which goals of mathematics education have been formulated

(a) Educational Structure:

Goals of mathematics education cannot exist in a vacuum. They exist within the framework of the educational structure of a particular country and the overall national goals of education.

When one examines the educational systems in Africa there is some evidence that most countries have been genuinely concerned with introducing changes into their systems to break away from the so called inherited cononial system.

These changes have mainly involved adjustments of an administrative nature aimed at righting various imbalances, such as accessibility to education. Yoloye (1980) has described this type of change as renovation. On the other hand there has been little structural change in the educational systems found in most African countries. One can easily say that there has been little innovation and almost no reform in the educational structures in Africa. Figure 1 shows that out of ten countries, among those that responded to our questionnaire, five countries have seven years of primary education (Uganda, Kenya, Tanzania, Botswana, and Tunisia), four have six years (Nigeria, Mauritius, Ethiopia and Gambia, and one country (Somalia) has eight years of primary education. Among those countries which have seven years of primary schooling, four have six years of secondary education (Kenya, Uganda, Tanzania and Tunisia), while one country, Botswana has five years of secondary education. Among those countries which have six years of primary education, Nigeria and Ethiopia have six years of secondary education, while Mauritius and Gambia have seven years of secondary education. Somalia has four years of secondary education beyond the eight years of primary.

Slightly over half of the countries reported in this study have 13 years of school excluding the nursery school. The rest have 12 years of school. Thus we note a great variation in the educational structures in different African countries. These variations imply that there should be differences in the national educational goals and in the goals of mathematics education.

There are four important aspects of educational structure which may have a bearing on goals of mathematics education. These are the number of pupils attending primary school and secondary school in each country, the percentage of pupils who proceed from primary school to secondary school and the age at which pupils start primary schooling.

Table I shows basic data for ten countries on these issues .

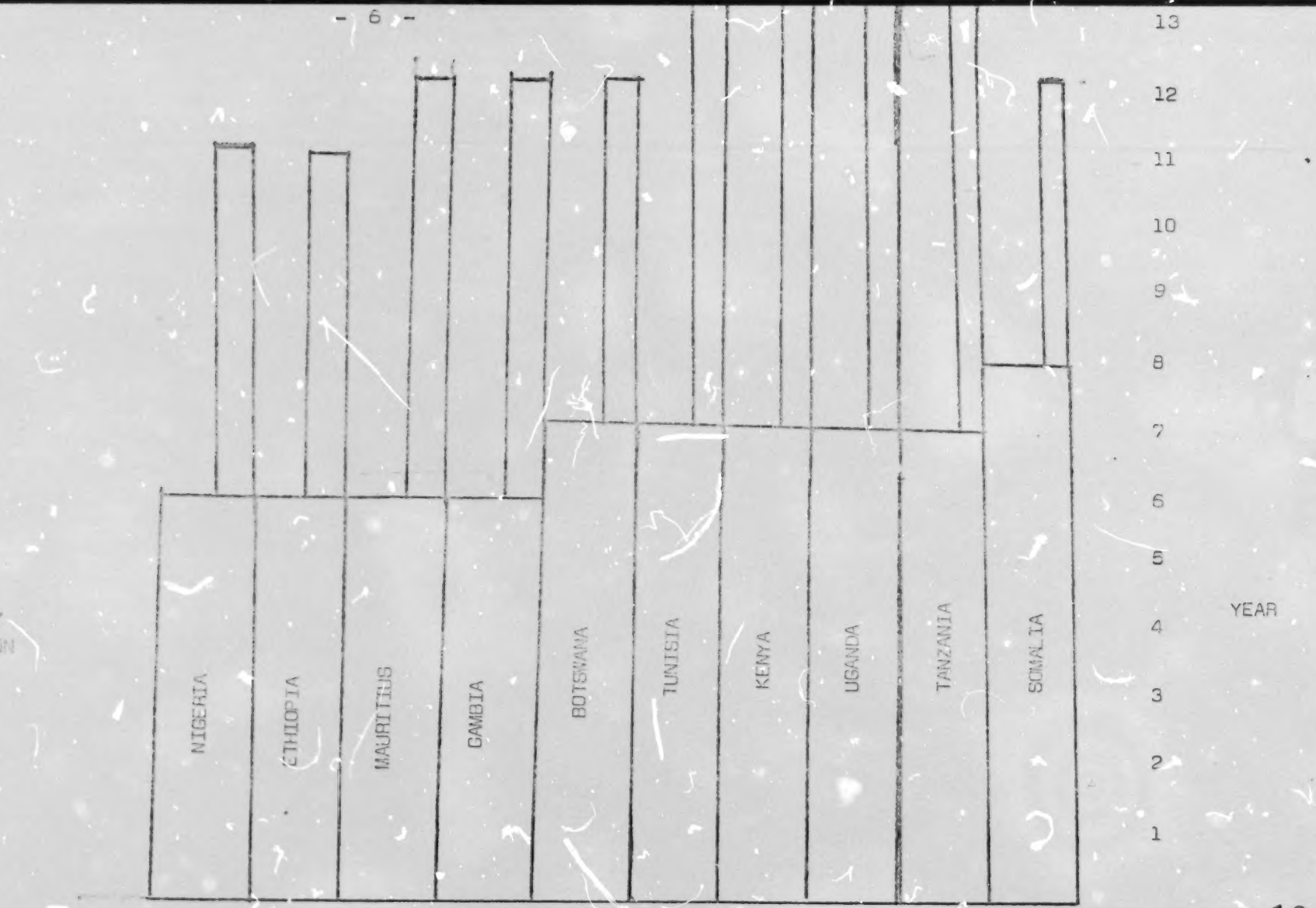


FIGURE I

THE SYSTEMS OF EDUCATION IN TEN COUNTRIES

TABLE I

THE SYSTEMS OF EDUCATION IN SELECTED COUNTRIES IN AFRICA:

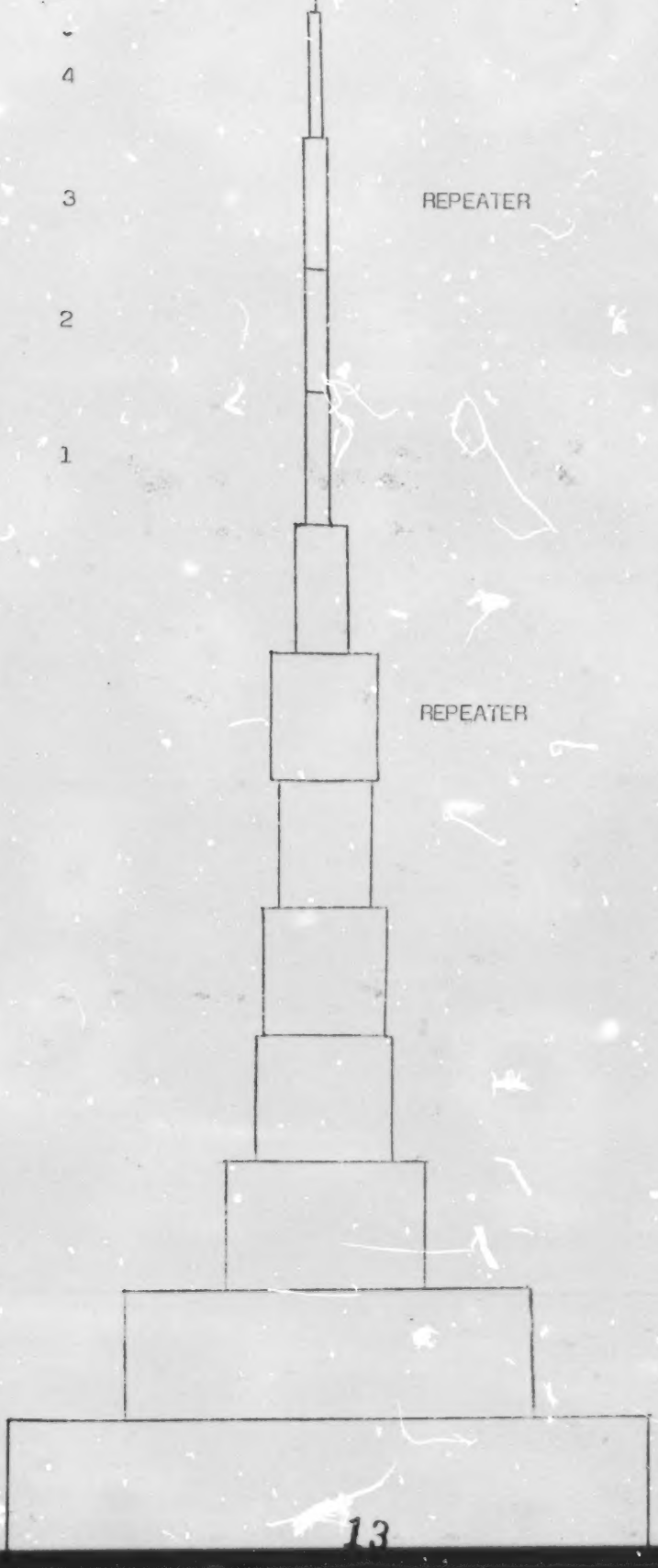
BASIC DATA

Country	Age of starting primary school	Number of pupils attending primary school	Percentage of primary school pupils who go to secondary	Number of pupils in secondary school
Botswana	6	180,000	35%	13,000
Ethiopia	7	2 millio	30%	430,000
Gambia	8	38,000	40%	8,400
Kenya	6	4 million	30%	800,000
Mauritius	5	90,000	89%	75,000
Nigeria	6	12.3 million	35%	2.4 million
Somalia	6	750,000	24%	250,000
Tanzania	7	3.2 million	9%	68,301
Tunisia	6	991,908	40%	241,908
Uganda	6	-	25%	-

The first observation to be made about the data reported in Table I is that primary education is terminal for most children in Africa. This implies that in considering goals of mathematics education, emphasis should be put on primary mathematics. Furthermore, before embarking on the exercise of formulating goals for mathematics, the curriculum developer should attempt to answer the question:-
What type of activities does an average primary school leaver engage in that require mathematics or mathematical thinking?
In answering this question, one should take into account the large number of children who drop from primary school virtually at all levels. This implies that one must consider the minimum level of mathematics expected of a primary school leaver.

The second observation which is related to the goals of mathematics concerns the small number of pupils who proceed from the primary school to the secondary school (with the exception of Mauritius). This implies that in most African countries, secondary education is elitist and highly selective. Educational pyramids are perhaps more pronounced in Africa than anywhere else in the Less Developed Countries. Figure 2 is an example of the Kenyan system of education in 1979 . The educational pyramid indicated in Figure 2 is typical of most educational systems in Africa. The pertinent question is: Does one prepare statements of goals of mathematics on the basis of such a pyramid? If the answer is "YES", then it implies that secondary school mathematics should be specialised. On the other hand, if the answer is "NO", then we must decide what proportion of secondary school mathematics should be regarded as general (minimal) for the majority of students who are likely not to continue with mathematics to University, and which proportion should be left for University-bound mathematics majors.

KENYA (1979) SHOWING
PERCENTAGE ENROLMENT



FORM	6		0.49%
	5		0.39%
	4		1.86%
	3	REPEATER	2.49%
	2		2.37%
	1		2.74%
STANDARD			
	VII		7.66%
	VI	REPEATER	16.49%
	V		14.3%
	IV		18.27%
	III		20.98%
	II		30.48%
	I		63.36%
TOTAL SCHOOL AGE 6			100.0%

Thirdly, the age at which children start school is an important variable in determining goals of mathematics education. As can be seen from Table I, all countries which participated in this study have official ages at which children in those countries should start schooling. However, it is a common knowledge, that these ages are not strictly observed when admitting pupils in the first grade.
This is especially so in the rural areas where dates for birth are not accurately recorded and where class repetition is often very high. Despite these problems, it is imperative that the age of the pupils should be taken into account while drawing up goals for mathematics education.

(b) The general goals of education:

Six countries were selected from the sample to study the general goals of education. These were: Nigeria, Tanzania, Kenya, Tunisia, Gambia and Ethiopia. We analysed the goals under two major categories: goals of primary education and goals of secondary education. Under each category we classified the goals into the following sub-categories: national unity, national development, social equality, cultural heritage and international consciousness. This classification was constructed with a view to see the extent to which goals of education were responsive to the needs of various African countries.
Tables II (a) and II (b) show the summary of goals of education in the six countries selected for this study.

From Table II (a), it is evident that primary education in most African countries is mainly concerned with the individual development of pupils. The goals of education seem to emphasize the imparting of cognitive skills that will be utilised in nation building. Among the major skills emphasized are: inculcation of numeracy and literacy and the development of manipulative skills. These skills are closely related to mathematics.

It therefore follows that these skills should be taken into account when formulating goals of mathematics. Other goals of primary education that seem to have a direct bearing on mathematics teaching are:-

(a) provision of basic skills for further education (Nigeria, Tunisia);

(b) promotion of innovative, creative and critical abilities (Tanzania, Gambia);

(c) development of basic skills to enhance adaptability (Kenya, Gambia);

(d) inculcation of sound values and attitudes (Nigeria, Kenya, Tanzania and Ethiopia).

Table II (b) shows the goals of secondary education. It has already been noted in the previous paragraphs that secondary education in most African countries is highly selective and limited to a tiny segment of the school population. This is not apparent in the statements of gaols of education. Although the goals cover a wider spectrum than those of primary education, the emphasis seems to be on the acquisition of basic skills and competencies for the development of society. The following is a sample of skills-acquisition goals: acquisition of skills, abilities and competencies (Nigeria); equip pupils with skills for work in villages and farms (Tanzania); develop scientific and technological skills (Tunisia). As in the case of primary education, there is a relationship between these skills and mathematics. The general goals of education incorporating these skills should therefore guide one in considering goals of mathematics education at this level.

2. Goals of Mathematics at the primary and secondary school levels

Table III shows a summary of goals of primary mathematics and secondary mathematics for six countries: Ethiopia, Morocco, Kenya, Tunisia, Nigeria and Tanzania.

TABLE II (a)

STATEMENTS OF GOALS OF PRIMARY EDUCATION IN SELECTED AFRICAN COUNTRIES

Category of national goals / Country	National Unity	National Development	Individual Development	Social Equality	Respect and development of cultural heritage	International Consciousness
Nigeria	Citizenship education	a) Character and moral training b) Develop* manipulative skills	a) Inculcate permanent literacy, numeracy* and ability to communicate b) Provide* basic skills for further education c) ability to adapt to a changing environment	Sound* attitudes		
Tanzania		To impart socialist values, attitudes and knowledge	a) To give* permanent ability in literacy b) develop* enquiring mind and ability to think and solve problems independently			

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PRIMARY

Category of national goals / Country	National Unity	National Development	Individual Development	Social Equality	Respect and development of cultural heritage	International Consciousness
Kenya	Foster a sense of nationhood and promote national unity	a) equip* pupils with skills, knowledge and expertise for self-employment and paid employment b) Help pupils adept to change	Character building - foster sound moral and religious values	Promote a sense of social responsibility and social equality	Respect, foster and develop Kenya's cultures	Foster positive attitudes to other countries
Tunisia		Prepare pupils to live in society	a) To do away* illiteracy b) To teach* pupils basic calculations c) prepare* pupils for secondary school education			

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PRIMARY

Category of national goals / Country	National Unity	National Development	Individual Development	Social Equality	Respect and development of cultural heritage	International Consciousness
Gambia			a) Development* of child's ability to think for himself and to solve his own problems b) Building of manual skills c) Development* of basic skills to enhance adaptability.			
Ethiopia	Education for solialist consciousness	a) Education for production b) Education for Science and research				

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TABLE II (b)

STATEMENTS OF GOALS OF SECONDARY EDUCATION IN SELECTED AFRICAN COUNTRIES

Classification of goals / Country	National Unity	National Development	Individual Development	Social Equality	Cultural heritage	International Consciousness
Nigeria	Foster Nigerian unity	Acquisition* of skills, abilities and competencies for contributing to the development of the society	Equip students* to live effectively in the modern age of science and technology		a) Inculcate right values and attitudes for the survival of the Nigerian Society b) Develop and project Nigerian culture, art and languages	
Tanzania	a) equip pupils* with skills for work in villages and farms b) to relate theory with practice c) Love and appreciate manual work					

SECONDARY

Classification of goals / Country	National Unity	National Development	Individual Development	Social Equality	Cultural heritage	International Consciousness
Kenya	Same as primary school	- do -	- do -	- do -	- do -	- do -
Tunisia		Prepare students for work after school	a) Developing* scientific and technological skills b) Prepare* for University education		Give cultural and literacy basis to the students	

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SECONDARY

Classification of goals / Country	National Unity	National Development	Individual Development	Social Equality	Cultural heritage	International Consciousness
Gambia			As in primary school	"		
Ethiopia	As in primary school	As in primary school				

Four cognitive levels were used in analysising the goals: computation (objectives which emphasize performing operations, not deciding which operations are appropriate), comprehension (objectives which emphasize understanding of concepts and their relationships), application (objectives which require students to use concepts in a specific context) and analysis (objectives which require non-routine application of concepts). While most of the goals fall under specific cognitive levels, there are several goals that cut across the levels.

Several conclusions may be drawn from the statements of goals summarised in Table III. First, the goals emphasize skill acquisition (both intellectual and manipulative). This is a good thing and ought to be encouraged in the future curriculum development efforts. However, a word of caution is appropriate in this connection. Mathematics education, especially at the primary school level, should not be reduced to only "sums". The popular slogan "Back to Basics" should not be interpreted merely as meaning the "Four rules of Arithmetic". Bryan Wilson in his paper to the Commonwealth Expert Meeting on Science and Mathematics Curricula (Cyprus, 1984) has observed that:-

> "The citizen of the future needs much more than routine computational ability. Given a practical situation, it is just as important to know whether to multiply as it is to know how to multiply".

The second point that is evident from Table III in the primary mathematics is viewed as a preparation of secondary mathematics. This is so despite the fact that in most countries in Africa, only a small minority of pupils proceed to the secondary school.

The goals of primary mathematics show that most countries have adopted a wide curriculum which stresses the development of concepts across a broad spectrum of mathematics. The consequence of this, is that majority of the primary school leavers lack understandings, attitudes and technical skills that are essential for them to function efficiently as citizens. This trend must be reversed if future generations are to be adequately prepared in mathematics for individual needs and the needs of society.

A major area missing in the statements of goals of mathematics is informatics. This is perhaps due to the fact that these goals were formulated in the 1960s and early 1970s. They have not been sufficiently reviewed to take into account the rapid growth of computers and calculators in recent years.

3. The content of primary and secondary mathematics:

Any discussion of goals of a subject cannot be complete without reference to the content of that subject. In this connection, I asked the Ss in this study to give details of the content covered in the primary school mathematics and secondary school mathematics.

At the primary school level the following content was found to be common to most curricula: number and number operations, fractions, ratios and percentages, decimals, measurements, reading of simple graphs, simple geometry and mensuration. There were some important topics that were found to be missing in several curricula: approximation and estimation of both numbers and measures, statistical ideas, development of critical faculty towards data, simple ideas of probability and spatial skills. These topics seem to be essential in mathematics education at the primary level and should be incorporated into the school syllabus.

The common ground covered in the secondary school mathematics content was as follows:

In Arithmetic - basic operations, decimals, fractions, two and three dimensional shapes and objects and their properties, percentage in various applications, ratio and proportion, statistical charts and averages, simple linear equations, graphs of simple relations, substitution in formula, changing subject of equation, factors multiple and primes, negative number and indices, square roots, logarithms, number patterns, pythagoras, similar figures, bearings and metric units and rate of change.

In Geometry the curricula were more variable but there was general agreement that properties, area or volume, of two and three dimensional objects should be known, many syllabuses included surface area and volume of spheres, pyramids and cones. Loci and simple constructions appeared in all syllabuses. The circle appeared in all syllabuses although there were differences in opinion concerning the extent to which it should be covered. Most syllabuses included chords, angles in circles and tangents. There was a difference in opinion as to the theorems which the students should be able to prove; the intesecting chord and the angle between tangent and chord was quite popular.

In Algebra it was generally agreed that functions, negative and fractional indices, simultaneous equations, quadratic equations, factorisation, transposition of simple formula, algebraic fractions, graphical solutions to problems and direct and inverse proportion should be included in secondary school mathematics.

Most syllabuses include Banking, Post Office, electricity bills, water rates, house buying (where relevant), and simple accounts. Some syllabuses perhaps went too far and included topics such as shares, cash book keeping and one case double entry ledgers to be taught in the second year secondary.

It can be argued that it does not matter too much what content one teaches as long as the basic operations necessary for life have been covered. What is important is how the subject is taught and learned.

There is however a need to some guidelines regarding what is expected of pupils and teachers in mathematics education. The following list is a summary of such guidelines:-

1. Pupils should develop an understanding of the mathematical terms they will meet in the world around them.

2. Pupils should be able to express their every day problems in mathematical language and should be able to apply the generalisations they have learnt to solve these problems.

3. Pupils should learn how to learn; how to make their own classifications and generalisations.

4. Teachers should develop the pupils' ability to reason logically, critically and unemotionally and to communicate their ideas clearly. At the same time however, they should be shown how to use their imagination and develop flexibility - there is not always one right way.

5. The pupils' interest in mathematics should be stimulated so that they will wish to continue their studies.

6. Adequate information should be supplied to the pupils to enable them study other subjects.

To achieve these aims, there is a need to:-

(a) study the environment in which the children will live or may live in the future to ascertain what content should be included in the syllabus;

(b) study future employment possibilities;

(c) Study future courses in mathematics to which we hope some will aspire and decide to what extent higher courses should affect our course.

(d) Study parallel science courses and make sure the children are taught the mathematics necessary for these courses;

(e) Consider what percentage of the children taking the course will finish the study of mathematics at the end of the course and decide how this should affect the content;

(f) Consider the equipment and staff available in schools to carry out the programme;

(g) Consider what methods of teaching are necessary to achieve our aims;

(h) Consider how teachers are to be informed on content and methods.

Some of these issues were examined at the international Conference on Developing Mathematics in the Third World Countries in Khartoum in 1979. It was recommended that on the basis of the information that was available, the following should be the broad goals of mathematics education :

(a) At the primary level

(i) Functional numeracy (including an understanding of place value, decimal fractions and an appreciation of the size of the number). 'Functional' implies not only knowing how but also when to perform an arithmetical operation.

(ii) Acquisition of certain mental attitudes to enable the development of problem-solving strategies.

(iii) Acquisition of techniques of representing and interpreting data (numerical and otherwise).

(iv) Measurement, approximation.

(v) Development of spatial concepts, and the ability to represent them; eg scale drawings, maps.

(b) at the Secondary level

(i) As in (a) above

(ii) Appropriate mathematics curricula for the technical and vocational sectors should be developed.

TABLE III (a)

GOALS OF PRIMARY MATHEMATICS

Country \ Cognitive Levels	Computation	Comprehension	Application	Analysis
Ethiopia	To provide basic knowledge and skills; operating with numbers	Pupils should know the structure of the number system	Collecting, organizing and interpreting data	
Morocco	a) Acquisition of mathematical knowledge b) Acquisition of certain working techniques and methods in mathematics	Development of child's intellectual ability		

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PRIMARY

Country \ Cognitive Levels	Computation	Comprehension	Application	Analysis
Kenya	a) Develop ability to perform functional operations b) Develop skills in measurement, approximation and estimation	a) Acquire an understanding of number and numeration b) Develop spatial concepts and ability to use them c) Acquire techniques of collecting, representing and interpreting data	a) Develop knowledge and manipulate skills in mathematics as used in various disciplines	Develop techniques of investigation and problem-solving techniques
Tunisia	a) Knowledge of basic arithmetic b) Recognize different geometric figures, constructing and classifying them		Mathematizing real simple situations	Learning basic and simple reasoning

Continued to Page 25

PRIMARY

Country \ Cognitive Levels	Computation	Comprehension	Application	Analysis
Nigeria	Pupils should be able to add, subtract, multiply and divide numbers	a) To use whole numbers and fractions b) To measure: length, area, volume, weight, time and money c) Identify, name and use 2-dimensional and 3-dimentional figures d) Read and understand simple statistical information	Apply simple statistical information	
Tanzania	To help pupils achieve practical capacity for measurement and computation	a) To help pupils acquire numeracy b) To help pupils acquire ability to think straight	To make pupils aware of the uses of maths beyong the classroom	

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Continued to Page 26

TABLE III (b)

GOALS OF SECONDARY MATHEMATICS

Country \ Cognitive Levels	Computation	Comprehension	Application	Analysis
Ethiopia		To have knowledge and understanding of mathematical processes, facts and concepts	To know the general problem - solving techniques	Developing scientific enquiry: mathematical logic, logical structures; deductive and inductive thinking
Morocco	Practice in calculations	Introduction of such notions as: - the theory of sets - binary relations - structures	a) Analysis of data b) create models	a) Training in logical reasoning b) Fostering intuition c) Develop creativity d) Training in vigour

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SECONDARY

Cognitive Levels / Country	Computation	Comprehension	Application	Analysis
Kenya		To provide understanding of basic mathematical concepts	To develop an ability to use and construct mathematical models of physical situations	To encourage an attitude of logical thought
Tunisia		a) Develop intellectual potentialities b) Preparing students for practical life c) Awakening of scientific mind		

Continued to Page 28

SECONDARY

Cognitive Levels / Country	Computation	Comprehension	Application	Analysis
Nigeria	a) Calculate measures using trigonometry ratios b) Identify and use simple statistical formulas in simple problems		Apply generalised properties of arithmetic or algebra to the solution of equations	a) To apply deductive reasoning b) Prove geometric properties of plane figures
Tanzania	To develop mathematical skills	To develop pupils abilities to discover mathematical concepts and also their ability to think logically	Mathematics as a tool for other subjects	

4. Curriculum Changes in Mathematics

The revolutionary changes that took place in mathematics in the 1960s touched almost every country in the world. It is therefore necessary to find out in what way these changes affected goals of mathematics education in Africa. Table IV shows the percentage of countries in Africa which experienced curriculum changes in the 1960s and 1970s. This Table shows that:-

TABLE IV

PERCENTAGE OF COUNTRIES WHICH EXPERIENCED CURRICULUM CHANGES IN MATHEMATICS

	1960s	1970s
Curriculum change in primary mathematics	50%	70%
Curriculum change in secondary mathematics	80%	50%

(a) In the 1960s, curriculum change in mathematics was more at the secondary school level than it was at the primary school level. While 80 per cent of the countries in Africa changed their mathematics curricula, only 50% of the countries changed the primary mathematics curricula. This was due to the emphasis that was put on secondary education soon after independence in most countries.

It can therefore be concluded that while goals of secondary school mathematics might have changed in most countries, the change in the goals of primary mathematics was not significant.

(b) It is interesting that in the 1970s more countries (70%) changed their primary mathematics curricula while fewer countries changed their secondary mathematics curricula (50%). This was partly due to disolusionment with secondary education as a panecea for all socio-economic problems.

(c) A study of the forces that led to curriculum changes in mathematics in Africa revealed that the main motivation for change was "changes in mathematics curriculum in other parts of the world". More than two thirds of the countries that had changes in the mathematics curriculum in the 1960s at the primary and secondary levels gave this as the main reason for change. Only one country said that curriculum change was brought about by "failure of the previous curriculum to meet the national needs," or because of "low achievement." There was more variation in the reasons given for the curriculum changes of the 1970s. At the primary level two fifths of the countries said that they changed their curriculum because of "the failure of previous curriculum to meet the national needs". The next group of countries attributed changes in their primary mathematics curriculum to "changes in mathematics curriculum in other parts of the world". A few countries said that they changed their curriculum because they were "dissatisfied with the content offerings", and because of "low achievement in mathematics".

Several conclusions can be drawn from these results. First, there was no concrete curriculum reform arising spontaneously from the needs in Africa. Instead, what we notice is an attempt to adopt and adept curriculum from elsewhere. This implies that the goals of education were 'borrowed' without paying much attention to their relevance. Secondly, there was a general decelaration in curriculum change in the 1970s which led to reverting to earlier forms of curriculum. This meant that instead of formulating goals that would lead to more contemporary mathematics, there were instances of putting the clock back.

Some of the problems experienced by various countries as a result of the curriculum changes of the 1960s and 1970s confirms the observation that the goals of mathematics were not formulated with foresight. The two major problems that have plagued majority of countries in Africa in mathematics teaching are: lack of text-books and a shortage of qualified mathematics teachers at all levels.

5. The most important goal of mathematics education in Africa

In recent years there has been a great deal of discussion concerning "minimal competencies in mathematics (see Richs, R.J. An International Review of minimal competency programs in math). This implies that each country can identify the most important /goal of mathematics education for its pupils. The data from this study show that in Africa the two most important goals are:

(a) Preparing pupils for the next cycle of education and

(b) preparing pupils to be self-reliant.

Nearly two thirds of the countries which participated in this study said that the major goal of their primary mathematics is to prepare pupils for secondary school. This is despite the fact that for the majority of these pupils primary education is terminal. A half of the countries regard the main goal of secondary mathematics to be preparation for university mathematics. Preparing pupils to be self-reliant was considered to be an important goal of school mathematics with less priority.

It is interesting that although a significant proportion of school leavers in Africa must end up in a rural environment, no single country among our respondents considered the goal "preparing pupils for living in rural areas" to be an important goal.

6. Agents of curriculum change

When discussing goals of education it is often assumed that there is a systematic process that is followed in formulating them. To test this hypothesis, we asked our respondents to answer three questions in connection with goals of mathematics:-

(a) Who makes major decisions in curriculum change in mathematics?

(b) Who is the most influential person in causing curriculum change in mathematics?

(c) What criteria has been used in the past in formulating goals of mathematics?

On the first question we found that for the majority of countries decisions on curriculum change are made by either the Curriculum Development Centres or Institutes of Education in those countries, at least in theory. Examples were given where, despite this provision, decisions were taken either through Ministerial decrees or Presidential pronouncements. In some countries, it is the Minister who decides on the curriculum change. It was only in two countries where we were told that Mathematics Teachers Associations have a say on changes in the mathematics curriculum. The type of goals of mathematics formulated for any country will often depend on who initiated the formulation. In this connection we were concerned with the level of influence in curriculum change by various groups of people. More than 80 per cent of our respondents said that politicians are the most influential group when it comes to curriculum change. Teachers accounted for only one fifth of the influence in curriculum change (presumably through their Teachers Associations). There is a clear need to involve teachers more in the formulation of goals of mathematics and in the curriculum developments process.

All the countries in this study had no criteria for formulating goals of mathematics. Because of this, most of these countries find it easier to copy wholesale goals from elsewhere even if they are irrelevant.

7. Instructional time

Time is an important variable in the learning - teaching process. It must be taken into account in formulating goals of any subject. One must know in advance if he has time to achieve the goals before him.

We have already said earlier that mathematics has a special place in the school curriculum. The data in this study showed that the median number of periods for mathematics was as follows:-

Lower Primary School	- 5 periods.
Upper Primary School	- 5 periods.
Secondary School (up to O-Level)	- 6 periods.
Secondary School (A-Level)	- 6 periods.

This appears to be adequate time to enable teachers attain well formulated goals of mathematics, provided that the goals are desirable.

8. Language

The issue of language of instruction especially in the primary school has not been resolved in most African countries. This has a direct bearing on the goals of mathematics. Table V below shows: (a) the percentage of countries using various languages for instruction and (b) percentage of countries with text-books written in various languages. Several observations can be made from this table:-

(a) Although 80 per cent of countries give instruction in the lower primary school in the mother tongue of the pupils, less than half of those countries have no textbooks in the relevant vernaculars. More than 90 per cent of the countries have books either in English or French.

TABLE V

PERCENTAGE OF COUNTRIES USING VARIOUS LANGUAGES OF INSTRUCTION AT DIFFERENT LEVELS

	Lower Primary Instruction	Lower Primary Textbooks	Upper Primary Instruction	Upper Primary Textbooks	Secondary Instruction	Secondary Textbooks
Mother tongue	80%	10%	20%	20%	-	-
French	20%	95%	90%	100%	100%	100%
English	10%	90%	70%	100%	100%	100%

(b) Instruction in mathematics in the upper primary school and in the secondary school is all in a foreign language - either English or French. The text-books are all in these languages.

These factors must be taken into account while formulating new goals of mathematics especially with regards to attainability of the goals.

Conclusion:

This study has shown that most countries in Africa have not seriously considered the goals of mathematics in relation to their needs and the needs of the African child. In the light of the evidence discussed in the above paragraphs, there are several recommendations that should be considered for future action:-

(a) A regional workshop should be convened to discuss appropriate goals of mathematics at the primary school level, secondary school level and at tertiary level. UNESCO with the African Commission on Mathematics Education should plan for such a workshop soon.

(b) There is an urgent need for research on various issues affecting the learning, teaching and usage of mathematics. Here, I would like to reiterate the UNESCO's Experts Meeting (ED-80/CONF. 614/14 of March, 1981) recommendation One:

"Research should be encouraged into the determination of the various levels of understanding of mathematical content attained by children in different countries".

There is also a need to carry out research in other areas such as: acquisition and retention of basic mathematical skills, the role of mathematics in different work settings, especially in the rural areas e.t.c.

(c) To-date the only means available for evaluating goals of mathematics in most African countries are external examinations. The long-term effects of mathematics education have not been evaluated. It is recommended that some comperative studies be commissioned in different African countries.

(d) Teachers should be made the main agents of curriculum change. They should be involved in formulating goals of mathematics.

(e) The issue of instructional media in general and text-books in particular need urgent attention. It has a significant implication on the achievement of goals of mathematics.

(f) Language as a medium of instruction is still a major problem in most African countries. Despite the recommendations of the Nairobi Symposium on Interactions between Linguistics and Mathematical Education (Nairobi 1974) no action has been taken in most African countries. It is recommended that a meeting of experts in Africa be convened soon to review those recommendations in order to suggest possible future action.

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